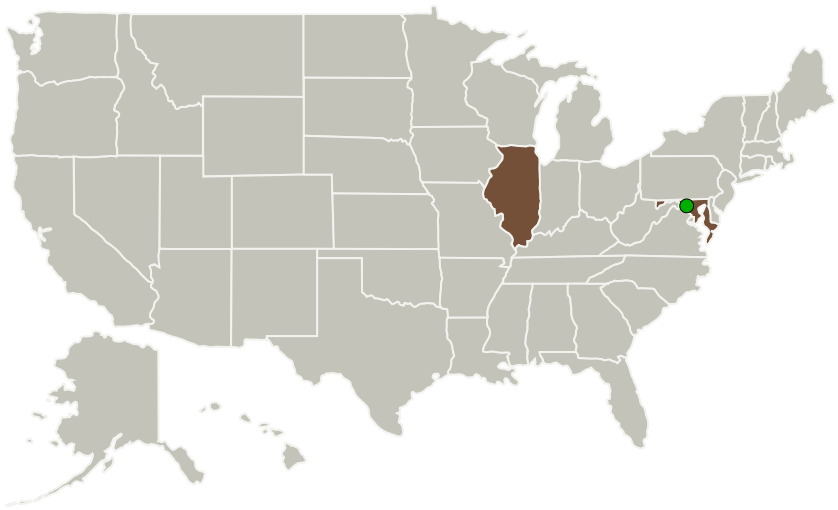
CUA OpenMP Nonlinear Optimization Tool, Phase I

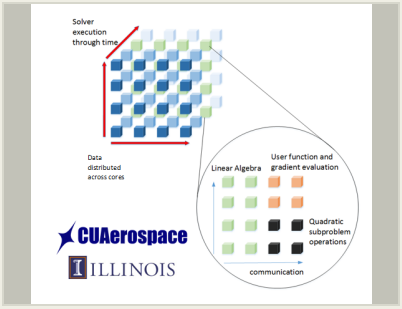
Completed Technology Project (2017 - 2017)

Project Introduction

Nonlinear programming (NLP) allows for the solution of complex engineering problems, however, none of the currently available solvers capitalizes on parallel computing. Many NASA trajectory design packages (OTIS, EMTG, MALTO) have already had their own code streamlined, and it is now the serial execution of existing NLP solvers that represents the largest bottleneck. CU Aerospace has an existing prototype of this kind of solver, the Nonlinear Parallel Optimization Tool (NLPAROPT), which has already demonstrated speed superiority over comparable serial algorithms and shown that there remains significant potential for improvements. Currently, NLPAROPT is restricted to run on distributed memory systems. It is the goal of this Phase I effort to create a sister program to NLPAROPT, the CUA OpenMP Nonlinear Optimization Tool (COMPNOT), which will be compatible with shared memory systems. As large-scale shared memory parallel systems, such as Intel's Xeon Phi family, become more commercially available, COMPNOT will greatly expand the market for this NLP solver, even enabling most modern desktop computers to effectively run it. Additionally, Phase I will entail developing hardware-specific optimization, focusing on the Intel Math Kernel Library (MKL), but other platforms will be explored as well. At the end of Phase I, can begin integration into NASA trajectory design packages, significantly reducing the time-to-solution.

Primary U.S. Work Locations and Key Partners





CUA OpenMP Nonlinear Optimization Tool, Phase I Briefing Chart Image

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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
CU Aerospace, LLC	Lead Organization	Industry	Champaign, Illinois
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Illinois	Maryland

Project Transitions

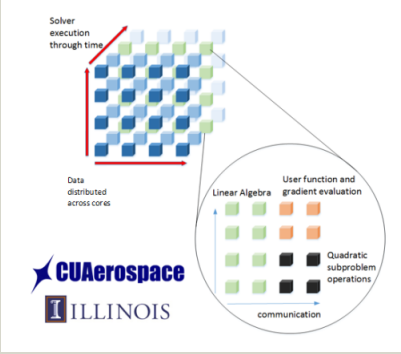
June 2017: Project Start

December 2017: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140760)*

Images



Briefing Chart Image
CUA OpenMP Nonlinear Optimization Tool, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/132015)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
CU Aerospace, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

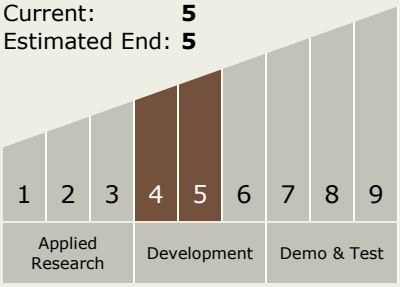
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Alexander R Ghosh

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.4 Network Provided Position, Navigation, and Timing
    - TX05.4.2 Revolutionary Position, Navigation, and Timing Technologies